(11) (A) No. 961232

(45) ISSUED Jan. 21, 1975

(62) CLASS 20-19
C.R. CL. 72-39

(19) (CA) # CANADIAN PATENT

(54) FLOORING SECTION AND COMPOSITE FLOOR UTILIZING THE SAME

(70) Curran, Bernard E., Sewickley, Pennsylvania, U.S.A.

Granted to H.H. Robertson Company, Pittsburgh, Pennsylvania, U.S.A.

(21) APPLICATION No. 114,899
(22) FILED June 4, 1971

(30) PRIORITY DATE July 2, 1970 (51,940) U.S.A.

No. OF CLAIMS 3

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SUBSTITUTE

REMPLACEMENT

SECTION is not Present

Cette Section est Absente

This invention relates to improved flooring sections and composite floor constructions utilizing the flooring sections.

The use of welded studs for achieving composite coaction between a metal beam and a covering concrete slab has been in the prior art for some time. See for example U. S. patent 2,987,855 issued June 13, 1961 to R. C. Singleton, et al. Welded studs are normally factory applied to structural beams which are thereafter erected in bridges, multi-story buildings and the like. The use of welded studs in multi-story buildings utilizing sheet metal flooring sections has been unsuccessful in the past because of the added expenses which are incurred. Factory installed studs cannot be considered for the reason that the studs themselves interfere with the positioning of the sheet metal flooring on the horizontal beams. The presence of numerous exposed vertical studs throughout the entire building construction presents a continuous severe safety hazard to workmen.

Field installed studs are inherently more expensive than factory installed studs. Moreover the studs are only effective when they are structurally integral with the building framework, i.e., the beam itself. Accordingly, it has been necessary to provide gaps in the flooring sections for shear connectors. See, for example, Journal of the American Concrete Institute, TA 681.A 61 Volume 18, Number 3, (November 1946) pages 241-248. Alternatively, it has been necessary to provide drilled, burned or punched holes in the sheet metal flooring to provide direct welding of the studs to the metal beam. See, for example, Civil Engineering, TA 1.C61, (October 1961) page 69. With relatively light gauge sheet metal decking, recent developments in the welding arts permit direct welding of shear-transferring studs through the light gauge decking directly into the horizontal

beams. However, with heavier gauge decking, e.g., sixteen gauge and thicker, and with double thickness metal cellular flooring sections, it is required to drill, burn or punch stud receiving holes in the decking to accommodate the welded studs. A recant development in this art, permits the shear-transferring welded studs to be applied directly to the fusion weld buttons which secure the sheet metal decking to the steel framework. See, for example, my U. S. patent 3,363,379 issued January 16, 1968 and assigned to the assignee of this invention.

The principal object of this invention is to provide an improved flooring section for use in composite floor constructions of the type utilizing welded studs.

Another object of this invention is to provide a corrugated flooring section having improved closure means for closing the opposite ends of the corrugation against ingress of a subsequently poured layer of concrete and which exposes upper surface portions of a subjacent horizontal beam for the installation of shear transfer elements directly to the horizontal beam.

The present invention provides a corrugated flooring section having improved closure means for closing the opposite ends of the corrugation. The improved closure means is formed solely from segments of the flooring section. The closure means closes the ends of the corrugations along closure edges which are substantially entirely inwardly offset from a line coincident with the transverse end of the flooring section.

The present flooring sections are erected in end-to-end abutted relation with the confronting transverse end overlying a horizontal beam. The flooring sections are secured to the horizontal beam along contiguous portions thereof, by plug welding. The opposed closure means of corresponding corrugations

expose upper surface portions of the horizontal beam. A shear-transferring stud is applied directly to each or selected ones of the exposed surface portions of the horizontal beam. When a layer of concrete is subsequently poured over the flooring sections, the shear-transferring studs connect the layer of concrete to the subjacent beams thereby achieving composite beam construction.

Heretofor, the use of shear-transferring studs has been limited to corrugated flooring sections having a height of about 1.5 inches. Studs in 3 inch heigh decking have been ineffective because of lack of embedment. The closure means of this invention may be provided in corrugated flooring sections having a height of 1½ to 3 inches. A flooring section having a height of 3 inches and incorporating the present closure means, may be assembled in a flooring structure with shear-transferring studs. The present closure means permit sufficient embedment of the studs to enable the studs to achieve full efficiency.

In the drawings which illustrate embodiments of the invention,

FIGURE 1 is a broken plan view of a flooring section incorporating closure means of this invention;

FIGURE 2 is a fragmentary perspective end view illustrating the closure means of this invention;

FIGURE 3 is a cross-sectional view taken along the line 3-3 of FIGURE 2;

FIGURE 4 is a fragmentary perspective view further illustrating the flooring section of FIGURE 1;

FIGURE 5 is a fragmentary perspective view of an alternative three-channel flooring section;

FIGURE 6 is a fragmentary perspective illustration of a floor construction utilizing the present flooring sections and composite beam construction;

FIGURE 7 is a fragmentary plan view of a floor construction of FIGURE 6 further illustrating the installation of the shear-transferring studs; and

FIGURE 8 is a cross-sectional view taken along the line 8-8 of FIGURE 7, illustrating the embedment of the shear-transferring stud in a layer of concrete.

FIGURES 1 and 4 illustrate a flooring section 10 having opposite transverse ends 11, 12. Marginal connecting means, such as a male lip 13 and a female lip 14 are formed along the opposite longitudinal sides of the flooring section 10 and adapt the flooring section 10 for side-by-side connection with adjacent flooring sections. The flooring section 10 is corrugated and presents alternating crests 15 and valleys 16 and generally vertical webs 17 connecting adjacent ones of the crests 15 and valleys 16. The flooring section 10 additionally includes side valleys 16a, 16b terminating in the male lip 13 and female lip 14, respectively.

It is a convenient concept when describing the flooring section 10, to state that the crests 15 and valleys 16 define alternating oppositely directed lengthwise troughs 18, 19 (FIGURE 4). This is, each trough 18 is defined by one of the crests 15 and the adjoining side walls 17 and is presented at one face of the flooring section 10, whereas each trough 19 is defined by one of the valleys 16 and the adjoining side walls 17 and is presented at the opposite face of the flooring section 10.

It will be observed by comparing FIGURES 3 and 4, that the side valley 16a, 16b and the intermediate valley 16 lie in a

common plane indicated by the dash-dot line 20 in FIGURE 3. Moreover, the crests 15 are essentially coplanar.

It will be observed from FIGURES 1 and 4 that closure means 21 are provided for substantially entirely closing the opposite ends of the lengthwise troughs 18 (FIGURE 4).

Referring to FIGURES 2 and 3, each of the closure means 21 comprises end segments, such as, a crest end segment 22 and web end segments 23, one on each side of the crest end segments 22. The crest end segment 22 extends from the adjoining crest 15 toward the common plane 20 (FIGURE 3). The web end segments 23 extend from the adjoining web 17 toward the common plane 20 (FIGURE 3). Each web end segment 23 adjoins the crest end segment 22 along a common side 24 (FIGURE 2).

Referring to FIGURE 2, it is a convenient concept when describing the closure means 21 to state that the closure means 21 closes the ends of the lengthwise troughs 18 (FIGURE 4) along closure edges 25 which are substantially entirely inwardly offset from a line 26 coincident, for example, with the transverse end 11 of the flooring section 10. As best shown in FIGURE 3, the closure edges 25 are substantially flush with the common plane 20.

The flooring section 10 of FIGURE 4 is a four-channel element having a height indicated at 27 and equal to, for example, 1½ inches.

FIGURE 5 illustrates a three-channel flooring section 28 having a height indicated at 29 which is greater than the height 27 of the flooring section 10 of FIGURE 4. For example, the flooring section 28 may have a height of 3 inches or more. The flooring section 28 is provided with closure means 21 for substantially entirely closing the lengthwise troughs 18 defined by the crests 15 and adjoining side walls 17.

FIGURE 6 illustrates a floor structure 30 having first flooring sections 10A assembled in side-by-side connected relation and resting on a building framework 31 of which only horizontal beams 32 are illustrated. The corresponding transverse ends of the first flooring sections 10A overlie the top flange 33 of the horizontal beam 32. Each of the valleys 16 of the flooring sections 10A are secured to the horizontal beam 32 by one or more fusion welds 34. As shown in FIGURE 7, second flooring sections 10B are similarly erected and secured to the top flange 33 by plural fusion welds 34.

In accordance with the present invention, the closure means 21A, 21B of the adjacent flooring sections 10A, 10B (FIGURE 7) are disposed in confronting relation to expose upper surface portions 35 of the top flange 33 of the horizontal beam 32. The surface portions 35 provide sites for the fusion welding of shear-transferring studs 36 directly to the top flange of the horizontal beam 32.

The shear-transferring stud 36 can be quickly applied to the surface portion 35 by means of electric arc stud welding equipment which consists of a welding gun which receives the stud. The loaded welding gun is positioned against the surface portion 35 (weld-site) and actuated. An electric arc fuses the weld-site metal. When the weld-site is properly molten, the gun plunges the stud into the molten puddle to achieve a rugged, secure stud attachment.

It should be readily apparent that through the use of the present flooring section 10, the operations of cutting, punching or burning openings in flooring sections to attach studs directly to a horizontal beam, have been eliminated.

Typical studs 36 have a shaft diameter of 0.5 - 1.0 inch and a head diameter of 1.0 - 2.0 inch. The head of the stud 36

is maintained above the crests 15 and at least 1 inch below the upper level of the subsequently poured concrete 37. The function of the studs 36 is to transfer shear stresses from the concrete 37 (FIGURE 8) directly to the subjacent horizontal beam 32. According to the present invention, the studs 36 are fully efficient for this purpose. The relatively large space 38 (FIGURE 8) made available by the confronting closure means 21A, 21B of the present flooring sections 10, permits sufficient embedment of the stud 36 to enable it to achieve full efficiency.

If desired, the flooring sections 10, 28 may be equipped with crest deformations 39 and web deformations 33 (FIGURE 5) of the type described in Canada patent 704,842 to achieve composite floor construction in addition to composite beam construction.

While the flooring sections 10, 28 of FIGURES 4, 5 are shown with four and three crests 15, respectively, it should be apparent that more or fewer crests could be provided. The minimum condition is where a single crest 15 and a pair of lateral valleys is presented.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows.

1. In a building floor structure having a horizontal beam including an upper horizontal flange, first flooring sections assembled in side-by-side connected relation and having corresponding first transverse ends overlying said top flange of said horizontal beam, second flooring sections assembled in side-by-side connected relation and having corresponding second transverse ends overlying said top flange of said horizontal beam, the first and second transverse ends of the first and second flooring sections being proximately disposed, said flooring sections presenting alternating crests and valleys defining alternating upwardly and downwardly directed lengthwise troughs, the downwardly directed lengthwise troughs of said first flooring sections being aligned with those of said second flooring sections, the improvement comprising:

closure means for closing each of the confronting ends of the downwardly directed lengthwise troughs of the first and second flooring sections, along closure edges substantially entirely inwardly offset from a line coincident with said transverse ends, said closure means being formed solely from uncut segments of said flooring sections,

said upper horizontal flange having upper surface portions exposed between said closure edges of the confronting

closure means of corresponding downwardly directed lengthwise troughs of said first and second flooring sections; and

a generally vertical stud, fusion welded directly to said upper horizontal flange at one of said upper surface portions.

2. The improvement defined in Claim 1 wherein said closure edges are substantially flush with the upper surface of said upper horizontal flange.

3. The improvement defined in Claim 1 wherein said flooring sections include webs connecting adjacent ones of said crests and said valleys, and said uncut segments comprise:

a crest end segment extending from the adjoining crest toward said upper horizontal flange; and

web end segments, one on each side of said crest end segment, each extending from the adjoining web toward said upper horizontal flange;

each of said web end segments having a side common with said crest end segment.

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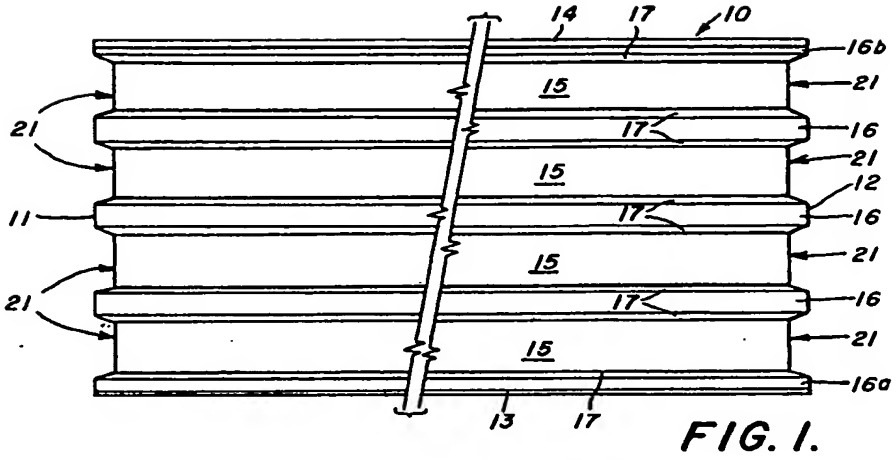

FIG. 1.

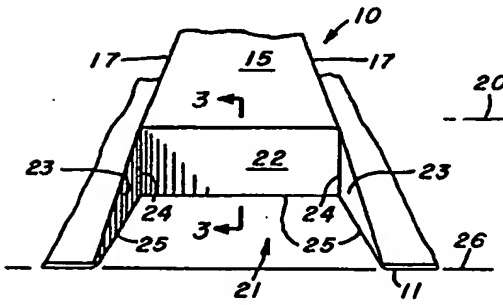

FIG. 2.

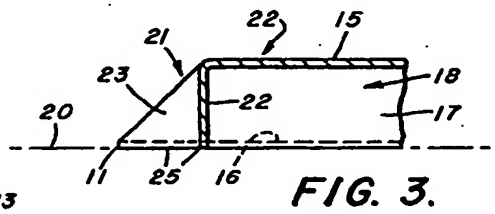

FIG. 3.

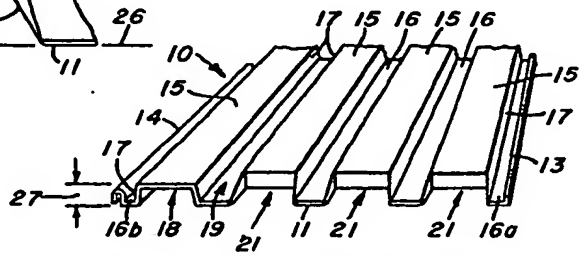

FIG. 4.

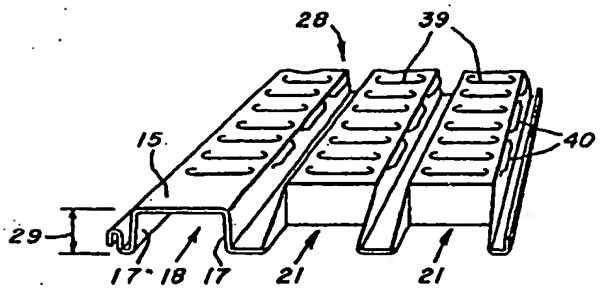

FIG. 5.

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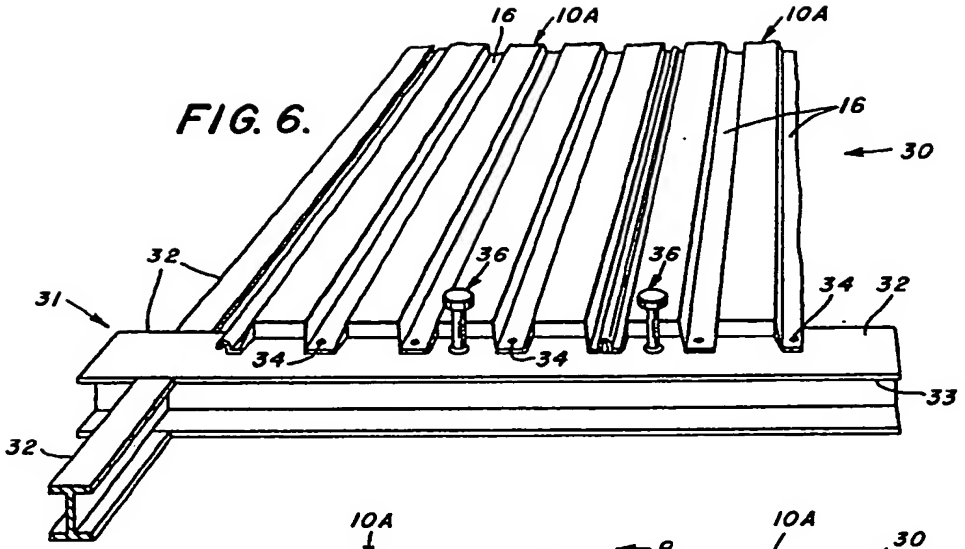
FIG. 6.



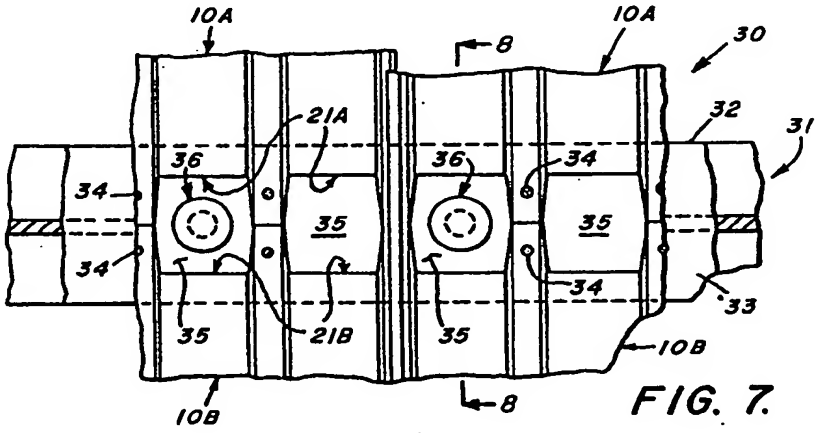


FIG. 7.

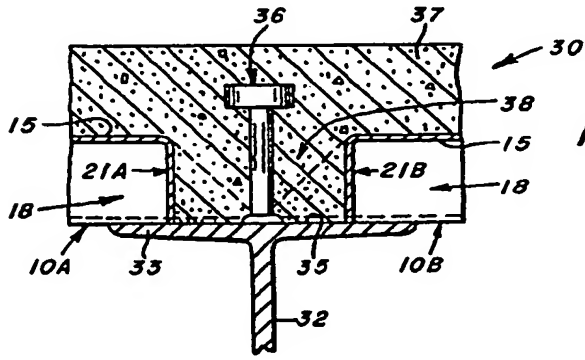


FIG. 8.

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